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मानक

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Mazdoor Kisan Shakti Sangathan

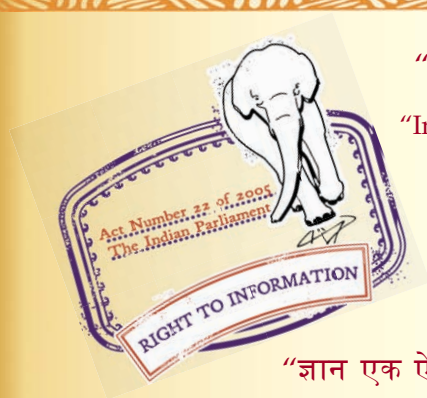
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

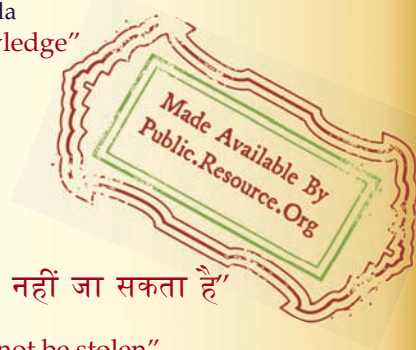
IS 1135 (1995): Springs - Leaf Springs Assembly for
Automobiles [TED 21: Spring]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
कमानियाँ — स्वचल वाहनों के लिए पत्तीदार कमानी
समुच्चय — विशिष्टि
(पाँचवाँ पुनरीक्षण)

Indian Standard

SPRINGS — LEAF SPRINGS ASSEMBLY FOR
AUTOMOBILES — SPECIFICATION
(*Fifth Revision*)

UDC 629.113.012.853

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (Fifth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Springs Sectional Committee had been approved by the Light Mechanical Engineering Division Council.

This standard, originally published in 1957, was revised in 1966, 1973, 1984 and 1989. This fifth revision incorporates a number of changes which were felt necessary as a result of further experience gained in the manufacture, use and testing of leaf springs in automobile suspension.

The main modifications are :

- a) The tolerances on assembled spring width and finished widths of the spring leaves are included.
- b) It has been established that rate of stroking during the endurance test does not materially effect the test results so long as the assembly under test is not allowed to heat up beyond 90°C.
- c) In view of (b) above the stroking rate of testing during the endurance test has been modified. This has now to be agreed to between the manufacturer and the user as it may vary depending on the testing facility available with the manufacturer/testing organizations.
- d) In order to simulate the installation of the spring assembly on the vehicle, the spring has to be clamped on the test rig in the manner similar to the installation on the vehicle. The clamping hardware is to be tightened to specified torque at the beginning of the test and this torque is to be verified and maintained at the end of 2 000, 5 000, 10 000 and 50 000 cycles.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SPRINGS — LEAF SPRINGS ASSEMBLY FOR AUTOMOBILES — SPECIFICATION

(Fifth Revision)

1 SCOPE

This standard covers requirements for leaf spring assemblies for automobile suspension.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
1500 : 1983	Method for Brinell hardness test for metallic materials (<i>second revision</i>)
3431 : 1982	Steel for manufacture of volute, helical and laminated springs for automotive suspension (<i>second revision</i>)
4163 : 1982	Method for determination of inclusion content in steel by microscopic method (<i>first revision</i>)
4905 : 1968	Methods for random sampling
7001 : 1989	Shot peening of steel parts (<i>first revision</i>)
8924 : 1978	Specification for bushes for leaf spring assemblies for automotive suspension
9211 : 1979	Denominations and definitions of weights of road vehicles
9484 : 1984	Specification for centre bolts for leaf springs
9574 : 1989	Leaf spring assembly — Clips (<i>first revision</i>)

3 TERMINOLOGY

3.1 Assembled Springs Width

Width of the spring where more than one leaf constitutes a spring assembly (*see* Fig. 1).

3.2 Bump Clearance

Difference in the opening or overall height between the design load position and the extreme position to which the spring can be deflected on the vehicle.

3.3 Camber

The distance from the datum line to the point where the centre bolt or the cup centre intersects the top surface of the main leaf. This may be either positive or negative (*see* Fig. 1, 2A and 2B).

3.4 Central Dimples

Spherical cup shaped projections of identical and matching shape in the leaves, intended to help in locating the relative positions of the leaves during the assembly of the spring (*see* Fig. 3).

3.5 Clamp Length/Inactive Length

Length of springs rendered inactive by the clamp located on the side opposite the spring seat. It is always less than the length in physical engagement with the clamp and is taken as the distance between the inner edges of the clamping bolts (*see* Fig. 1, 4 and 5).

3.6 Datum Line

This is the reference line used to define other terminologies. On springs with eyes, the datum line passes through the centre of the eyes. On other springs, it passes through the points where the load is applied near the ends of the spring. These points shall be indicated on the drawing.

3.7 Finished Width

Width to which the spring leaves are ground or milled to give the edges a flat bearing surface.

3.8 Free Height (Free Camber)

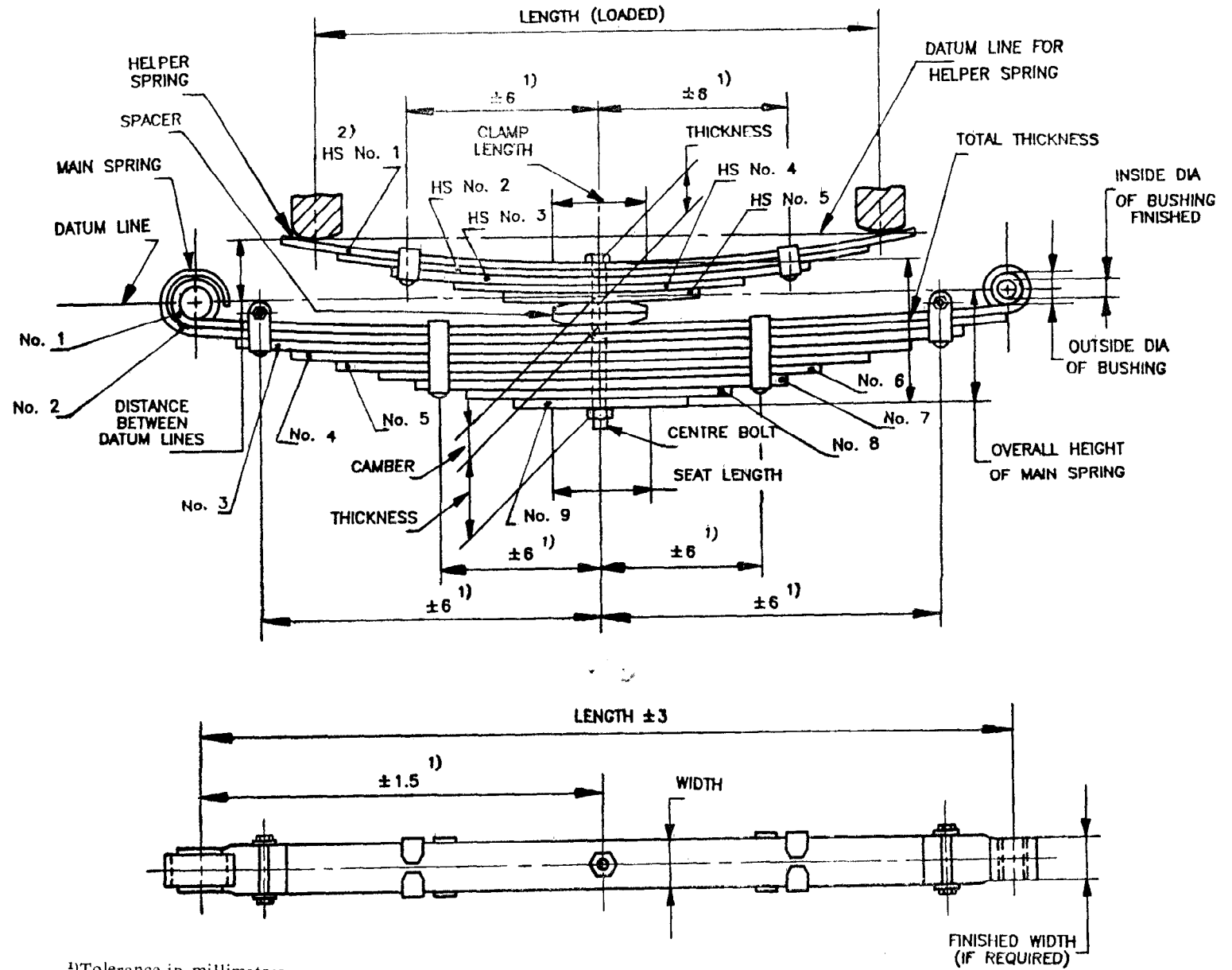
Distance from the datum line to the point where the centre bolt or the cup centre intersects the top surface of the main leaf when the spring is not loaded.

3.9 Laden Condition

This is the stationary condition of the vehicle when it is loaded to its maximum manufacturer's payload (*see* IS 9211 : 1979).

3.10 Leaf Number

Leaves are designated by numbers starting with the main leaf which is No. 1, the adjoining leaf



- 1) Tolerance in millimetres.
 2) HS means Helper Spring.

FIG. 1 SPRING LEAF ASSEMBLY WITH HELPER SPRING

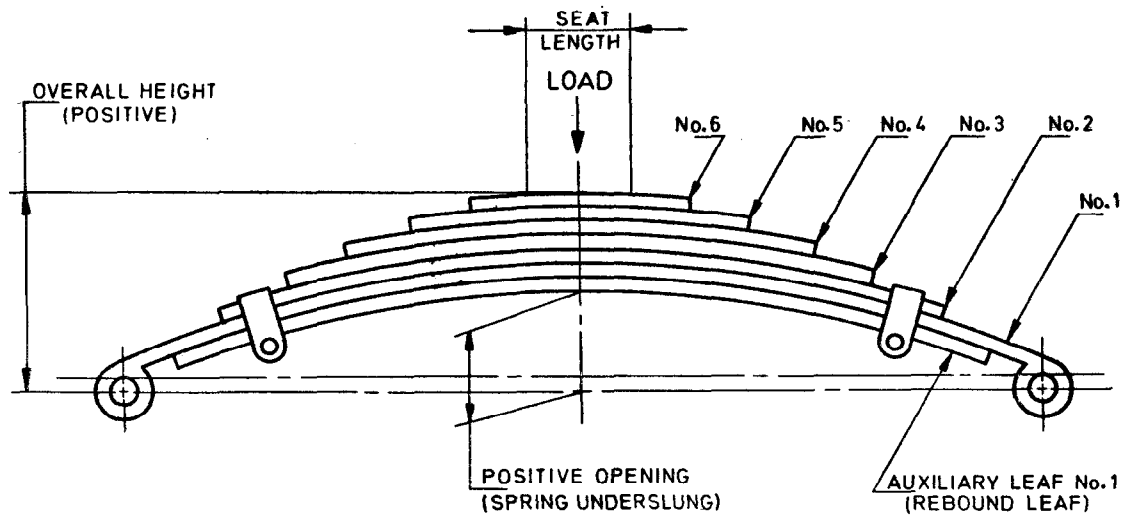


FIG. 2A MEASUREMENT OF POSITIVE OPENING AND POSITIVE OVERALL HEIGHT

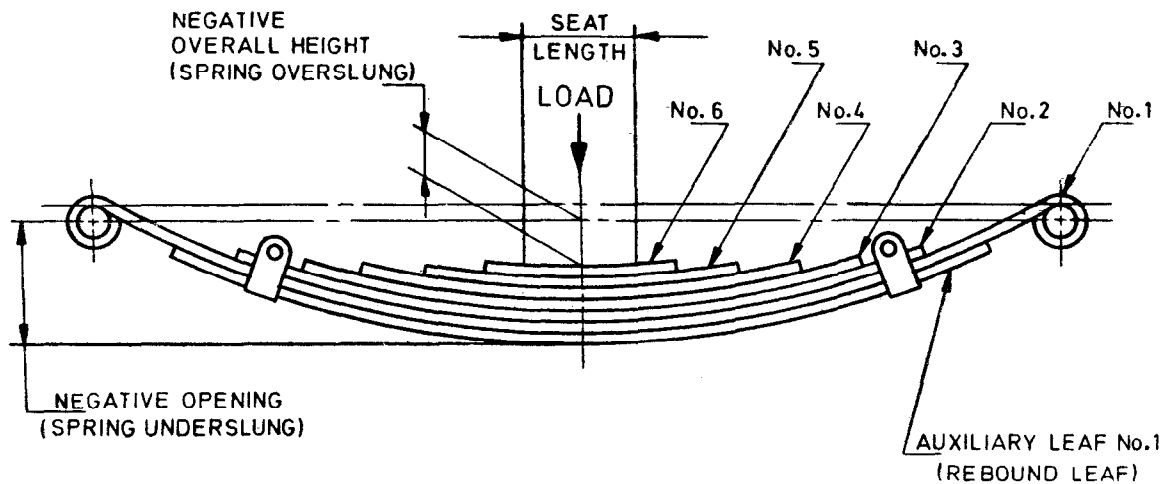


FIG. 2B MEASUREMENT OF NEGATIVE OPENING AND NEGATIVE OVERALL HEIGHT

is No. 2 and so on. If auxiliary or rebound leaves are used the auxiliary leaf adjoining the main leaf is auxiliary leaf No. 1 the next one auxiliary leaf No. 2 and so on. Auxiliary leaves are on that side of the main leaf on which load is applied to the spring ends, away from the side from which the load is applied to the spring centre. Helper springs are considered as separate units (Fig. 2A and 2B).

3.11 Leaf Spring Assembly

A spring of full elliptic, semielliptic or quarter elliptic shape with one or more leaves of constant or tapering width or thickness or by a combination of both. The leaves of the assembly are usually held together with a centre

bolt or a dummy clamp in case of spring assembly with dimple and are prevented from lateral shifting by alignment clips (see Fig. 1). For underslung springs, the head of the centre bolt or the dimple shall be adjacent to the main leaf and for overslung springs the head of centre bolt or dimple shall be adjacent to the short leaf (see Fig. 2A and 2B). Multi stage springs with variable load rate are shown in Fig. 1.

3.12 Load

The force exerted by the spring at any specified camber or overall height or overall opening. The load at any position will be the average of the compression load and the release load at that position.

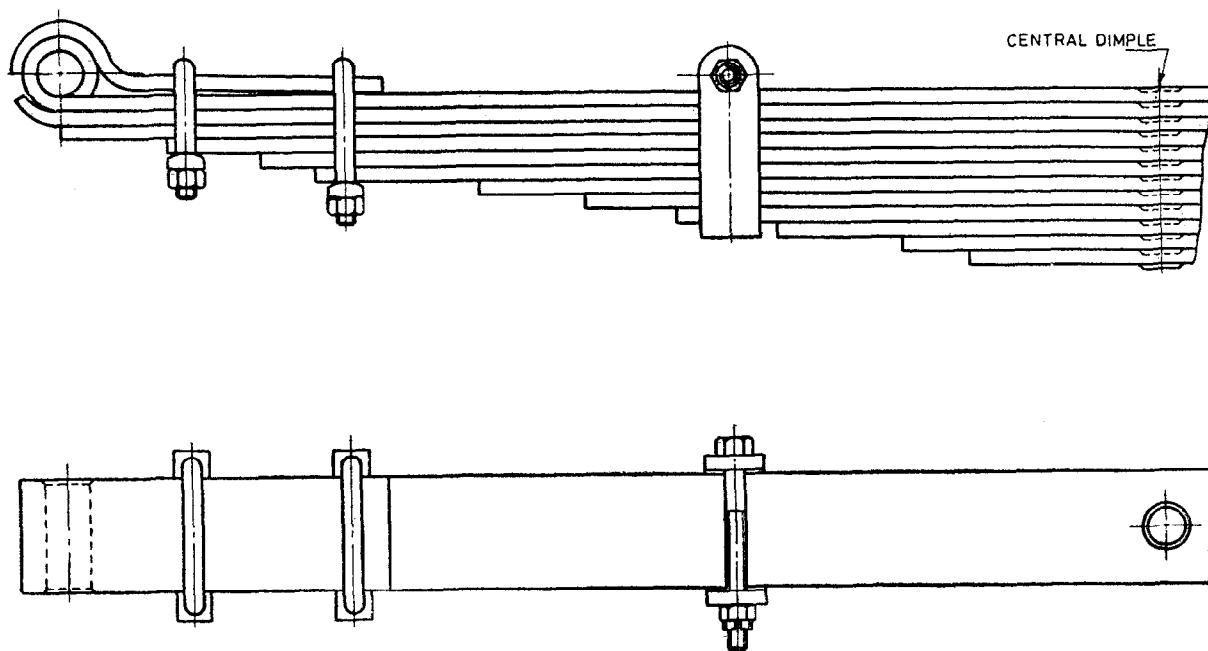
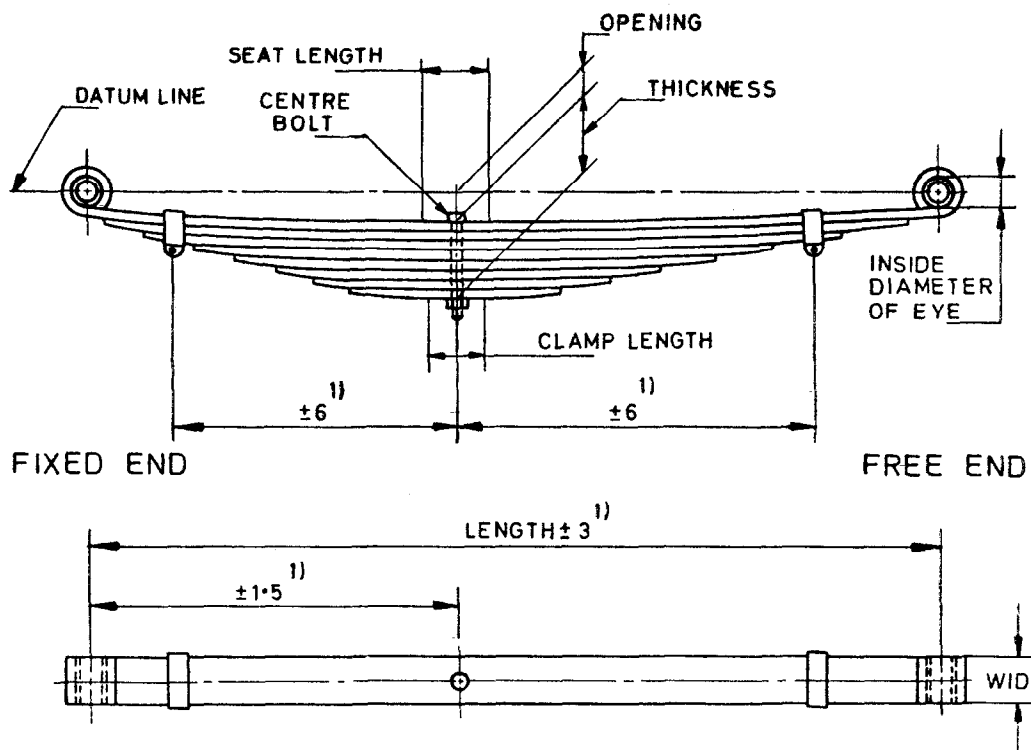
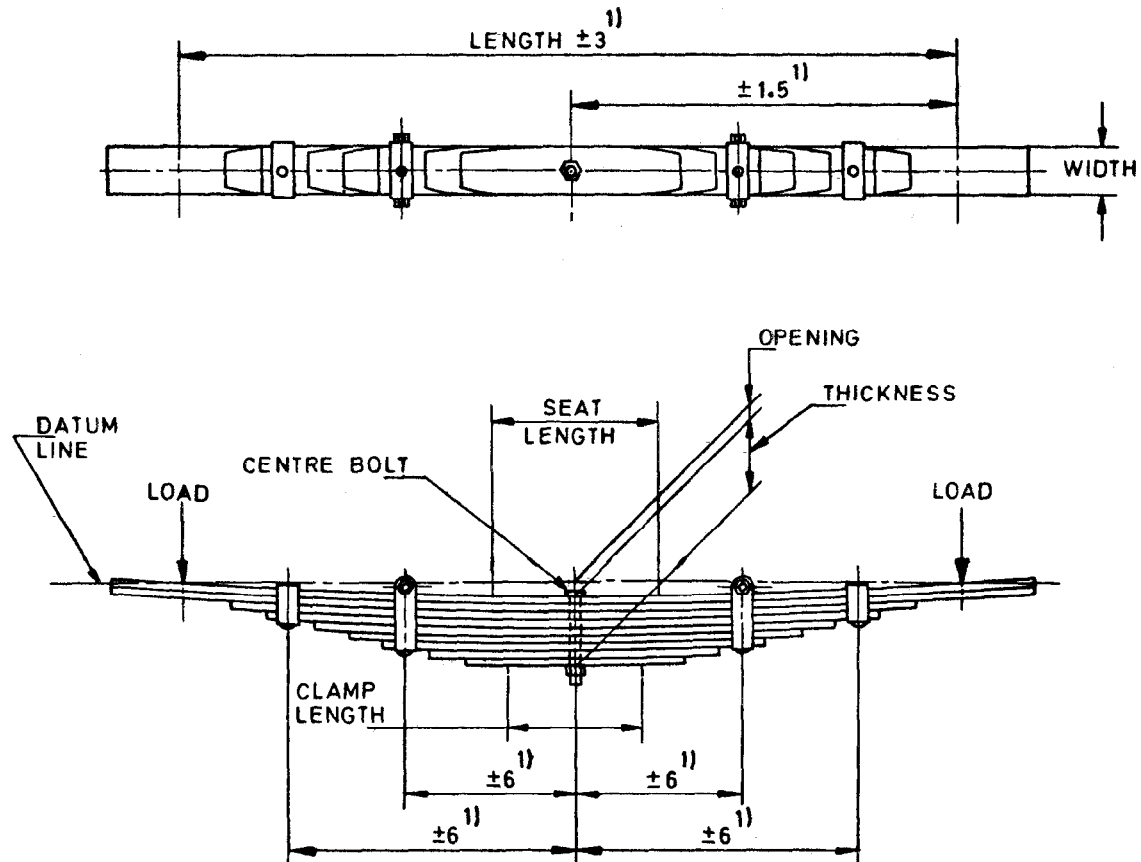


FIG. 3 LEAF SPRING ASSEMBLY WITH CENTRAL DIMPLES



¹⁾ Tolerance in millimetres.

FIG. 4 LEAF SPRING ASSEMBLY UNDER LOAD (UNDER SLUNG)



¹⁾ Tolerance in millimetres.

FIG. 5 SPRING DRAWN UNDER LOAD

3.13 Loaded Fixed End Length

Distance from the centre of the fixed eye to the projection on the datum line of the point where the centre line of the centre bolt intersects the spring surface in contact with the spring seat under specified loading conditions.

3.14 Loaded Height (Loaded Camber)

Distance from the datum line to the point where the centre bolt or the cup centre intersects the top surface of the main leaf when the spring is loaded.

3.15 Loaded Length

Distance between the spring eye centres when the spring is loaded to the specified load position. On springs without eyes it is the distance between the points where the load is applied under the specified conditions (see Fig. 1, 4 and 5).

3.16 Load Rate

The change of load per unit deflection generally expressed in N/mm. This is determined on a

spring assembly mounted on rollers without centre clamp and shackles.

3.17 Major Defects

Failure to satisfy the specified requirements while subjecting any spring to the tests for determination of hardness (see 6), load rate (see 15), and endurance (see 16).

3.18 Maximum Load

The maximum load experienced by the spring (typically twice the rated load or load when the spring touches the bump stop or the metal to metal position).

3.19 Minor Defects

Each instance of lack of conformity to the specification while inspecting any spring for the requirements other than those of the tests for determination of hardness, load rate and endurance.

3.20 Opening and Overall Height

Distance from the datum line to the point where the centre bolt or the cup centre line intersects

the surface of the spring that is in contact with the spring seat. If the surface in contact with the seat is on the main leaf or a rebound leaf (as on underslung springs) this distance is called opening or negative camber (see Fig. 4 and 5). If the surface in contact with the seat is on the shortest leaf (as on overslung springs) this distance is called overall height or positive camber (see Fig. 1). Opening and overall height may be positive or negative (see Fig. 2A and 2B). They are fixed reference dimensions. Tolerance is expressed in terms of either load or height.

3.21 Overall Spring Assembly Width

Maximum dimension of the spring width including clips, bolts, etc.

3.22 Rated Load

The load shared by the spring when the vehicle is loaded to its gross vehicle weight.

3.23 Seat Length

Length of the spring that is in actual engagement with the spring seat when installed on a vehicle. Seat length is always greater than the inactive length (see Fig. 1, 4 and 5).

3.24 Specified Load

The load specified by the designer. All the spring dimensions are specified on the drawings at this load.

3.25 Stack Height

Aggregate of the nominal thicknesses of all leaves of the spring including any liners and spacer plates which are part of the spring at the seat. For springs with helper springs, main and helper spring assembly are to be considered separately.

3.26 Straight Length

Distance between the eye centres or load centres when the main leaf is flat.

3.27 Test for Conformity of Production

All the tests specified in A-2 of Annex A.

3.28 Test for Type Approval

All the tests specified in A-2 of Annex A and endurance test as per 16.

4 MATERIAL FOR SPRING LEAVES

4.1 Material

Steels conforming to 55Si7, 60Si7, 65Si7, 50Cr4V2, 60Cr4V2, of IS 3431 : 1982 or other spring steel having similar hardenability, toughness and physical properties are considered suitable for manufacture of leaf spring. The

basic requirement of a leaf spring steel is that the selected grade of steel shall have sufficient hardenability for the size involved to ensure a fully martensitic structure throughout the entire section. The purchaser shall specify the type of material used by the manufacturer.

4.2 Surface Decarburization (Loss of Carbon)

Decarburization limits shall be as specified by the purchaser. If not, the decarburization depths shall be as below:

Leaf Thickness	Decarburization Depth	
	Complete	Total (Complete and Partial)
All sizes	0.10 Max	0.25 Max

4.3 Inclusion Rating

This should be as agreed to between the purchaser and the supplier and according to the rating given in Fig. 2 of IS 4163 : 1982. If not, this shall be 2.5 Max.

5 LEAF SECTIONS

5.1 The flats for leaf sections shall have bars flat surface. The edges shall be convex (see IS 3431 : 1982). The flats shall be straight and free from lateral kinks, waves, twists or other surface imperfections, such as splits, seams, flakes, pits, heavy scale, rust, blisters, laminations, crack edges and other rolling defects which render them unsatisfactory for spring manufacturing purposes.

5.2 Spring Flat Dimensions

Dimensions of the spring flats shall be as per agreement between the purchaser and the supplier.

5.3 Rolling Tolerances

Rolling tolerances shall be as specified in IS 3431 : 1982. The edge radius shall be $t/2$ unless otherwise specified where 't' is the thickness of the leaf section.

5.4 Tolerance on individual leaf length shall be ± 3 mm.

6 HARDNESS

6.1 The hardness of spring leaves when properly heat treated shall fall in the following range:

For materials 55Si7, 60Si7 and 65Si7 —
363 to 444 HB

For materials 50Cr4V2 and 60Cr4V2 —
415 to 485 HB

6.2 The hardness shall be measured at the compression side near the leaf centre as per IS 1500 : 1983. Hardness of any one leaf,

measured at different points shall not vary by more than 70% of the range specified.

7 SPRING EYES AND BUSHES

7.1 Commonly used eyes are given in Fig. 6. These are given for guidance only. The size and roundness of the eye should be checked by means of a round plug gauge (see Fig. 7) from which two opposite segments of 60° have been removed. The gauge shall have a taper on diameter per unit of length of 0.002 : 1. The gauge shall be inserted into the eyes three times from each side at angular positions differing by about 60° . The eye is acceptable only if the gauge reading on the side of the eye from which the gauge is inserted is within the specified diametral limits at each of the six checks. The eye should be checked with a round plug, GO/NO GO gauge to determine if the eye is cone shaped or tapered. The GO diameter shall pass completely through the eye and the NO GO diameter shall not enter the eye from either side.

Material : Suitable alloy steel or equivalent

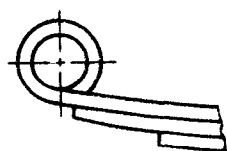
Process : Carburized and hardened;
Case depth 0.50 Min

Surface hardness : 58 HRC Min

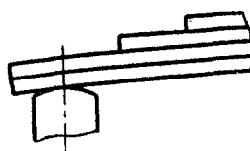
7.2 The total tolerance shall be 1 percent of the nominal diameter of the eye, except for large diameter eyes (40 mm or more) where bushing retention may require a smaller tolerance of 0.75 percent of the nominal eye diameter. For eye diameters of less than 25 mm the minimum tolerance is 0.25 mm.

7.3 Parallelism of Spring Eyes

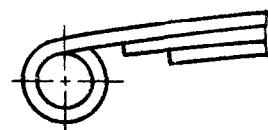
Eyes of the main leaf in the assembled spring measured in the unladen condition shall be parallel to the surface at the spring seat and square with the tangent to either edge of the main leaf at the spring seat, within $\pm 1^\circ$ or approximately ± 8 mm in 500 mm for commercial vehicles and $\pm 0^\circ 18'$ or ± 2.5 mm in 500 mm for passenger cars (see Fig. 8).



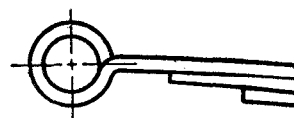
UP TURNED EYE



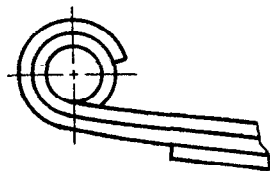
PLAIN END MOUNTING



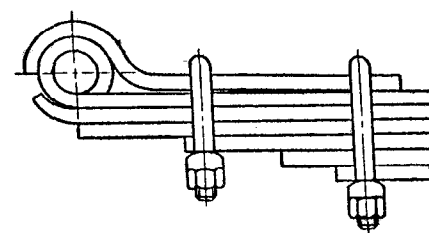
DOWN TURNED EYE



BERLIN EYE

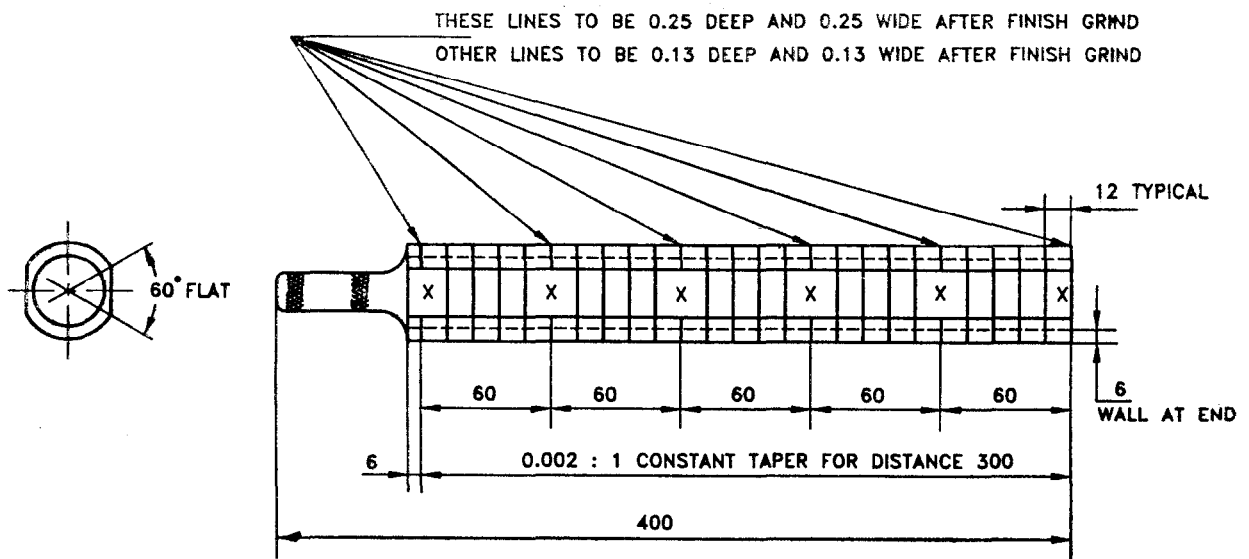


REINFORCED EYE



PRETENSIONED SPRING EYE

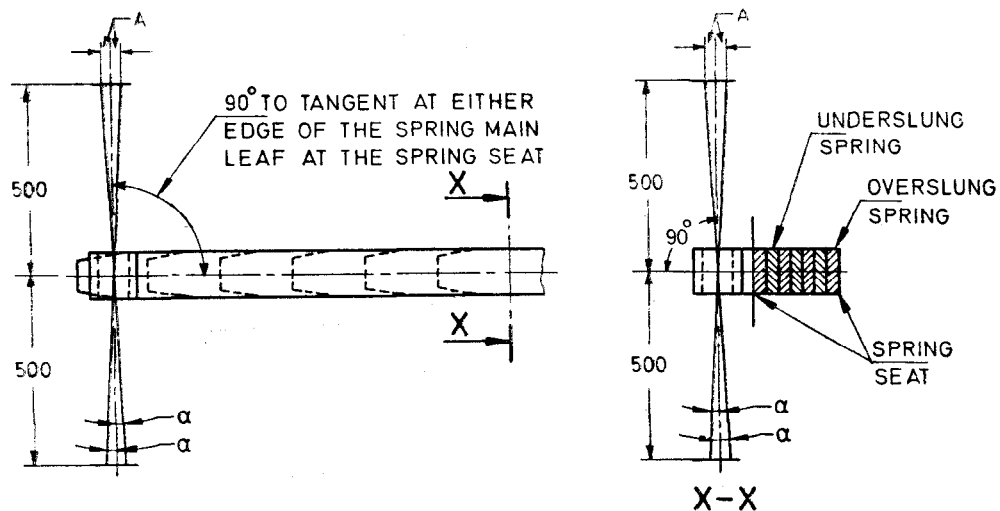
FIG. 6 COMMONLY USED SPRING EYES AND SPRING ENDS



X = STAMP GAUGE DIAMETERS AT THESE STATIONS

All dimensions in millimetres.

FIG. 7 GAUGE LEAF SPRING EYE PLUG



For passenger car spring ± 2.5 mm in 500 mm, $\alpha = 0^\circ 18'$

For commercial vehicle spring ± 8.0 mm in 500 mm $\alpha = 1^\circ$

All dimensions in millimetres.

FIG. 8 PARALLELISM OF SPRING EYES

7.4 Finished Width of the Eyes

The finished width of the eye shall be specified by the purchaser. Tolerances for the finished width shall be as follows:

Up to and including 50 mm	-0.15 mm to -0.3 mm
Over 50 mm	-0.2 mm to -0.4 mm

7.5 Bushes

The specification for the metallic bushes of ferrous and non-ferrous type shall be as per IS 8924 : 1978. Other material for metallic bushes shall be used as agreed to between the purchaser and the supplier. The specification for rubber bushes or silent block bushes shall be as agreed to between the purchaser and the supplier.

8 LEAF ENDS

8.1 Shape

The shape of the leaf ends shall be as agreed to between the supplier and the purchaser. All ends are to be rounded or chamfered to prevent digging.

8.2 Relief on Leaf Ends

Subject to agreement between the supplier and the purchaser, the bearing surfaces of the leaves may be ground, bent or coined. When ground, the grinding marks shall be along the length of the leaves. The length to be ground shall be specified by the purchaser (see Fig. 9).

8.3 End Gap

If end gap is provided, it shall not exceed 2.5 mm under no load condition.

9 CENTRE BOLT

The centre bolt is required to hold the spring leaves together, and the centre bolt head is used as a locating dowel during installation on the vehicle. For underslung springs, the head should be adjacent to the main leaf. For overslung springs, the head should be adjacent to the shortest leaf. Centre bolts and hole tolerance shall be as per IS 9484 : 1984.

10 CUP CENTRE (CENTRAL NIBBING ARRANGEMENT)

An alternative design to centre bolts is to have centre nibbing with dimples. This is often used

in heavy duty springs which may not safely depend on clamps and centre bolts to prevent a shifting of the spring on the axle seat due to driving and braking forces. When the main leaf is assembled adjacent to the axle seat as in underslung springs, the cup is hot forged towards the main leaf and for overslung springs, the cup shall be hot forged towards the shortest leaf. All cups shall be in the form of truncated cones within 45° sides (see Fig. 10). The diameter of the cup should not exceed one half of the leaf width and the depth of the cup should not exceed one half of the leaf thickness. The maximum movement between adjacent leaves shall be 0.25 mm and that between the main leaf and the last/shortest leaf shall be 3 mm.

11 ALIGNMENT CLIPS

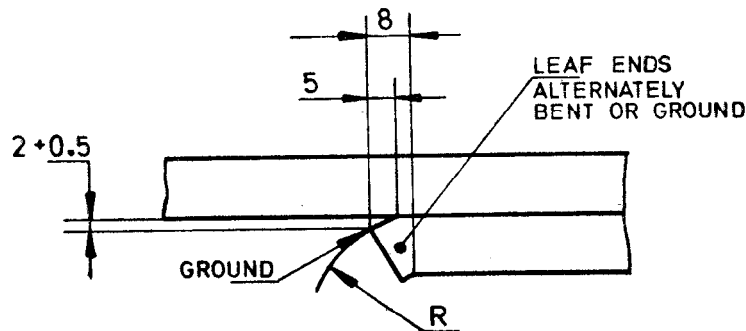
These are primarily used to prevent sidewise spread and vertical separation of the springs and shall be as per IS 9574 : 1989. Where metal spring covers are used, alignment clips may be omitted.

12 TOLERANCES ON SPRING ASSEMBLIES

12.1 The tolerances on dimensions along the length of the spring assembly are specified in Fig. 1, 4 and 5.

12.2 Tolerance on the loaded length shall be ± 3 mm.

12.3 Tolerance on laden camber shall be ± 5 mm.



All dimensions in millimetres.

FIG. 9 RELIEF ON LEAF END

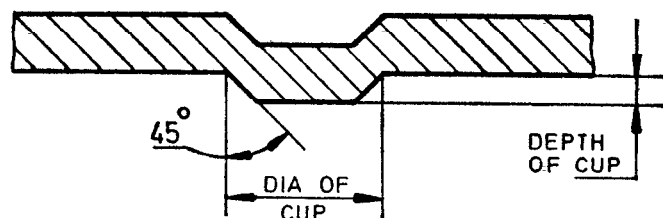


FIG. 10 CENTRAL NIBBING WITH DIMPLES

12.4 Tolerances for finished widths of the spring leaves are as below:

<i>Leaf Width (mm)</i>		<i>Tolerance</i>
<i>Above</i>	<i>Up to and Including</i>	
0	50	+ 0.00 - 0.25
50	63	+ 0.00 - 0.35
63	150	+ 0.00 - 0.50

12.5 The tolerances on overall width of the spring assembly shall be as below:

<i>Assembled Spring Width (mm)</i>		<i>Tolerance</i>
<i>Above</i>	<i>Up to and Including</i>	
0	63	- 0.00 + 2.5
63	100	- 0.00 + 3.0
100	125	- 0.00 + 3.7
125	150	- 0.00 + 4.4

12.6 No internal gap shall be allowed in laden condition.

13 ASSEMBLY AND FINISH

13.1 Finish of the Leaf Spring

The springs shall be supplied free from burrs on the bearing sides with all loose scales removed.

13.2 Shot Peening/Stress Peening

This shall be carried out on the tension side of spring leaves according to IS 7001 : 1989. The minimum coverage of peening shall be 90 percent. The intensity of shot peening shall be as agreed between the manufacturer and the purchaser. However, the recommended range is as follows:

<i>Type of Springs</i>	<i>Reading of Almen Gauge</i>
Medium and light duty springs	10 A to 20 A
Heavy duty springs	7 C to 15 C

No cold working shall be done to correct camber after shot peening.

13.3 Lubrication of Leaf Springs

As agreed between the purchaser and the supplier, the bearing surface of the spring leaves shall be lubricated by suitable lubricants.

13.4 Protective Coating of Spring Assembly

The spring assembly shall be protected against corrosion both in storage and in operational environments by a suitable rust inhibiting fluid or paint as desired by the purchaser.

13.5 Scragging of Spring Assembly

The spring assemblies before delivery shall be scragged, that is, deflected three times in quick succession to the maximum deflection specified in the drawing or by an amount which will develop a maximum stress equal to 90 percent of the yield stress of the spring leaf material in its heat treated condition. The permanent set after the scrag test shall not be more than 5 mm.

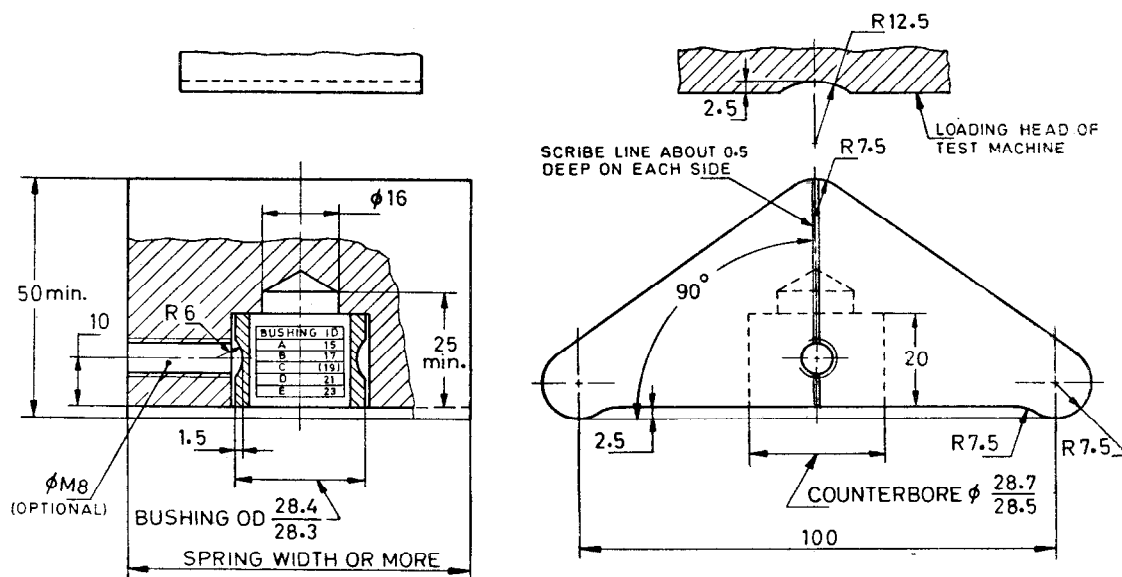
14 SAMPLING

For ascertaining the conformity of production, procedure given in Annex A shall be followed. Otherwise a procedure as agreed between the manufacturer and the supplier may be followed.

15 TEST FOR LOAD RATE

15.1 The spring ends shall be mounted in carriage(s) with rollers and shall be free to move in the direction of the datum line. The spring shall be supported on its ends and the load applied downward to the shortest leaf. The loading block (see Fig. 11) through which the load is applied shall be coaxial over the centre bolt/cup centre with the legs of the V resting on the spring. The legs of this block shall not be longer than the seat length. The load specified on the drawing does not include the weight of the spring or the loading block. The assembled spring shall then be deflected thrice by an amount according to the design specification (or in case if the above is not specified, by an amount which shall develop a stress equal to 90 percent of the yield stress of the spring leaf material in its heat treated condition). After this operation the spring shall be compressed from no load to maximum load and released to its no load position. The loads corresponding to 25 percent of the maximum spring deflection below and above the rated load position during the compression and release of the spring should be noted.

The load rate is the slope of the average of the compression and release loads at the two deflections recorded above, as seen in Fig. 12.



All dimensions in millimetres.

FIG. 11 RECOMMENDED SPRING LOADING BLOCK

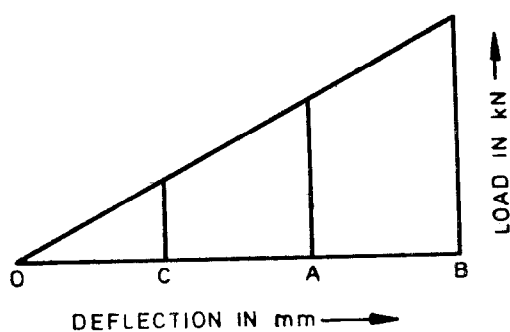


FIG. 12 LOAD DEFLECTION

OA — Load/Deflection corresponding to rated load;

OB — Load/Deflection corresponding to maximum load experienced under actual vehicle conditions — typically 2 g, where g is the load shared by springs under the laden condition of the vehicle;

OC — Load/Deflection corresponding to

$$OC = OA - \frac{(OB - OA)}{2}$$

For multi-stage springs the load rate shall be measured as agreed between the supplier and the purchaser.

15.2 Requirements

The tolerance on load rate and loaded height shall conform to the following limits:

Tolerance on Nominal Rate	Tolerance on Nominal Loaded Height
---------------------------------	--

For spring rates below ± 5 percent ± 3 mm
4.4 kN/25 mm

For spring rates ± 7 percent ± 5 mm
4.5 kN/25 mm and above

16 PROCEDURE FOR ENDURANCE TEST (TYPE APPROVAL TEST)

16.1 Equipment

Test machine should be able to maintain the maximum and minimum specified deflection/load within $\pm 2\%$, unless otherwise specified.

16.2 Clamping

The spring shall be clamped in the centre to simulate its installation in the vehicle (see Fig. 13). However the clamping parts and assembly requirements shall be as specified by the vehicle manufacturer. The clamping hardware shall be tightened to the torque values specified and verified throughout the test. These

torque values are to be measured and brought up to the specification at 2 000, 5 000, 10 000 and 50 000 cycles.

16.3 Rate of Testing

Springs shall be cycled at any convenient rate. However, it should be ensured that the surface temperature of the spring does not exceed 90°C. Fans may be used to cool the spring.

16.4 Fatigue Test Procedure

The number of samples to be tested should be as agreed between the supplier and the purchaser. The fatigue test shall be conducted in deflection. The spring shall be loaded from *OC* to *OB* as defined in Fig. 12. Typically this can be between 0.5 times the rated load to twice the rated load unless otherwise specified. The load at rated load position shall be measured at periodic intervals unless otherwise specified and on completion of the test to determine the change in load.

16.5 Fatigue Failure Criteria

16.5.1 Inability of the Spring to Sustain Load

If the change in load during the test or on completion of the test is more than 7 percent of the rated load at the start of the test.

16.5.2 The permanent set after the endurance test should not be more than 5 mm.

16.5.3 Visible crack in any of the leaves.

16.6 Acceptance Criteria

Acceptance criteria shall be minimum 100 000 cycles on deflection basis without any of the failures mentioned in 16.5 unless otherwise specified. For multi-stage springs, the acceptance criteria may be as agreed between the supplier and the purchaser.

17 MARKING

17.1 Source of manufacture shall be legibly marked on the main leaf at a place not detrimental to the life and service of the leaf spring assembly. When required by the purchaser, code for the type of steel used shall also be marked, if possible.

17.2 BIS Certification Marking

The product may also be marked with the Standard Mark.

17.2.1 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

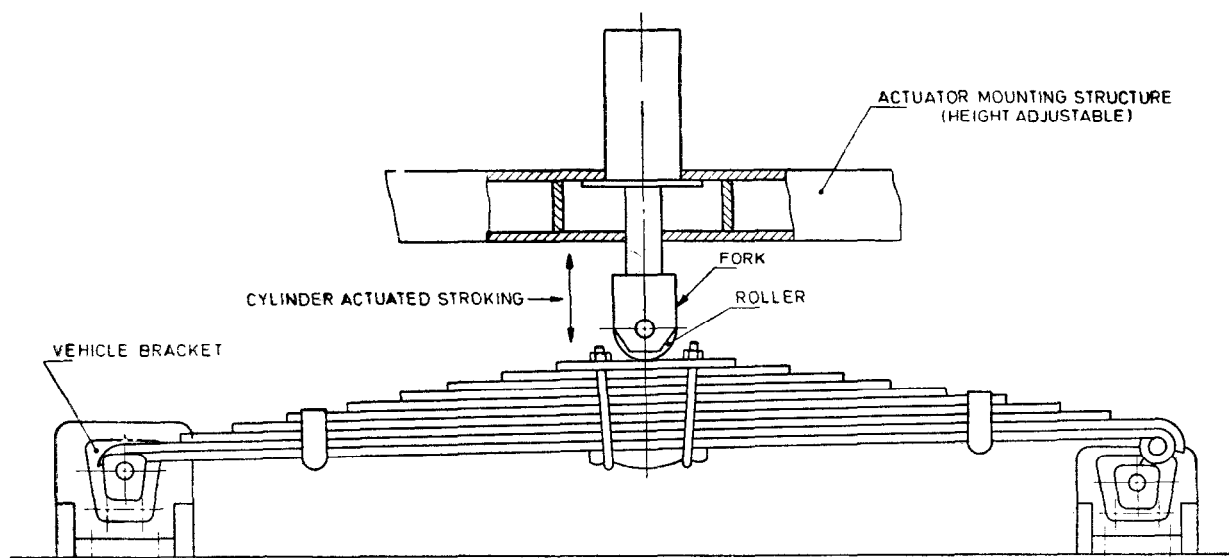


FIG. 13 ENDURANCE TESTING OF SHACKLE TYPE LEAF SPRINGS NOT HAVING AN AUXILIARY RACK

ANNEX A

(Clause 14)

SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

A-1 SCALE OF SAMPLING

A-1.1 In any consignment all the springs of the same type and manufactured from the same material under essentially similar conditions of manufacture shall be grouped together to constitute a lot.

A-1.2 For ascertaining the conformity of the lot to the requirements of the specification, tests shall be carried out for each lot separately. The number of springs to be selected at random for this purpose shall be in accordance with col 1 and 2 of Table 1.

A-1.3 In order to ensure the randomness of selection, the random number table drawn from IS 4905 : 1968 may be used.

A-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

A-2.1 All the springs selected in accordance with col 1 and 2 of Table 1 shall be subjected to the tests for material (*see 4.1*), surface decarburization if specified (*see 4.2*), inclusion rating (*see 4.3*), leaf sections (*5.1*), spring flat dimensions if required (*see 5.2*), rolling tolerances (*see 5.3*), hardness (*see 6*), spring eyes (*see 7.1*), parallelism of spring eyes (*see 7.3*), finished width of the eyes (*see 7.4*), relief on spring ends if required (*see 8.2*), hole diameter/cup centre as the case may be (*see 9*

Table 1 Scale of Sampling and Criteria for Conformity

(Clause A-1.2)

Lot Size <i>N</i>	Sample Size <i>n</i>	Permissible No. of Defects	
		Minor	Major
(1)	(2)	(3)	(4)
Up to 25	3	1	0
26 to 50	5	2	0
51 to 100	8	3	1
101 to 150	13	5	1
151 to 300	20	7	2
301 to 500	32	10	2
501 to 1 000	50	14	3
1 001 to 3 000	80	21	5

and 10), alignment clips (*see 11*), tolerances on assembled spring (*see 12.1* to *12.5*), surface finish (*see 13.1*), protection against corrosion (*see 13.4*) and load rate test (*see 15*).

The number of each of major and minor defects (*see 3.17* and *3.19*) observed shall be noted down.

A-2.2 The lot shall be declared as conforming to this specification if the spring tested satisfies the requirements of col 3 and 4 of Table 1.

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This Indian Standard has been developed from Doc No: LM 17 (0225).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{ 331 01 31 331 13 75
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054	{ 37 84 99, 37 85 61 37 86 26, 37 86 62
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TO
IS 1135 : 1995 SPRINGS — LEAF SPRINGS
ASSEMBLY FOR AUTOMOBILES — SPECIFICATION
(Fifth Revision)

(Page 3, clause 3.12) — Substitute the following for the existing clause:

‘3.12 Load

The force exerted by the spring at any specified camber or overall height or overall opening.

3.12.1 The load at any position will be the average of the compression load and the release load at that position.’

(Page 5, clause 3.14, line 4) — Insert ‘to the specified load’ after the word ‘loaded’.

(Page 10, clause 13.1, heading) — Insert ‘**Surface Condition**’ after the words ‘**Leaf Spring**’.

(Page 10, clause 13.3) — Substitute the following for the existing clause:

‘13.3 Lubrication of Leaf Springs

As agreed to between the purchaser and the supplier, the tension surface of the spring leaves shall be lubricated with graphite grease or suitable lubricants.’

(Page 10, clause 15.1, line 19) — Substitute the following after ‘....condition)’::

‘After preloading operation the following shall be recorded:

- a) Free height.
- b) Compression loads at 25 mm above and below the working load; deflect further by 25 mm or up to maximum deflection whichever is less and then slowly release the load and record.

- c) Release loads at 25 mm below and 25 mm above the specified point.
- d) The free height at the end of the test.

Load rate is given by half the difference of averages of loads recorded in (b) and (c) above and is expressed in kN/mm.

15.1.1 For multistage springs the load rate shall be measured as agreed to between the supplier and purchaser.'

(Page 11, Fig. 12) — Shift 'Fig. 12 and text matter below upto

$$OC = OA - \frac{(OB - OA)}{2} \text{ below 16.4.}$$

(Page 11, clause 15.2) — Substitute the following for the existing clause:

15.2 Requirements

15.2.1 The free heights as recorded in 15.1(a) and (b) above shall not differ appreciably.

15.2.2 The tolerance on load rate and loaded height shall conform to the following limits:

	<i>Tolerance on Nominal Rate</i>	<i>Tolerance on Nominal Loaded Rate Height</i>
	Percent	mm
For spring rates below 4.5 kN/25 mm	± 5	± 5
For spring rates 4.5 kN/ 25 mm and above	± 7	± 5

(Page 12, clause 16.4, sentence 3) — Substitute the following for the existing sentence:

'The spring shall be cycled between deflection values corresponding to OC and OB as defined in Fig. 12.'

(TED 21)